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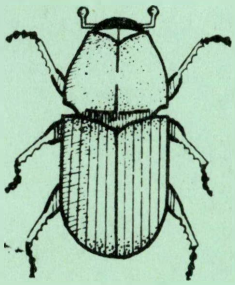

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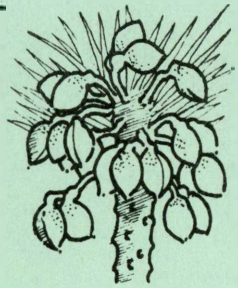

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A WESTERN SPRUCE BUDWORM IMPACT SURVEY ON THE CLEARWATER NATIONAL FOREST

by

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INTRODUCTION

The current western spruce budworm, *Choristoneura occidentalis* (Free.), outbreak was first detected on the Clearwater National Forest in 1966. The infestation has continued to expand until now over 500,000 acres have visible defoliation. Incipient western budworm populations exist throughout the remaining fir type in State, Federal, and private lands.

In some areas, the intensity of the defoliation has subsided somewhat; in other areas, damage has been extreme for the duration of the infestation.

The impact of the budworm outbreak on the forest environment is subject to much speculation. No one can deny the esthetic impact when in late July and early August each year vast acreages of fir and spruce type turn brown. Cone production is believed to have been affected. In areas of repeated defoliation, tree growth almost certainly has been reduced. While no extensive mortality has been observed, some top killing has occurred.

In the fall of 1971, a western budworm impact survey was initiated on the Clearwater NF. The primary objectives of this survey were to determine how much volume is infested and how much top killing has occurred. It was also hoped to get some estimate of the impact upon tree growth.

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METHODS

Selection of the Survey Areas

Because of manpower and financial limitations, it was decided to confine the survey to three separate areas of 300 to 500 acres each. The areas were to be predominantly fir and spruce in the pole or small sawlog size class since they are the size class in which the budworm would have the most adverse effect. Each area was to have a history of repeated defoliation with one area having been infested for at least 3 years and one area with at least 5 successive years of defoliation.

Several potential survey stands were located and examined on the ground. Three stands and one alternate were selected to be surveyed. The areas selected were in Yoosa Creek on the Pierce District, Hungary Creek on the Lochsa District, and Squaw Creek and Indian Grave Creek on the Powell District.

Because of personnel limitations imposed shortly after the survey began, only the Yoosa Creek stand of 500 acres was completed. Western spruce budworm was first detected in this stand in 1969.

Survey Design

The Yoosa Creek area boundaries were delineated on an aerial photograph. Survey strips 10 chains apart were laid out in a cardinal direction on the photograph. Because the recently completed Yoosa Creek road did not appear in the photograph, the starting points for the strips were determined by using a "ready" mapper. Strips were run in both directions from the road to the predetermined boundary of the stand.

Twenty BAF plots were taken at 5-chain intervals along the survey strips. Starting points and plot centers were marked so that plots could be reread in the future. In addition, each tree in the plot was numbered.

Data Collection

Data was recorded by modifying the regional ADP cruise sheets. Data included species, d.b.h., height, nondefoliated, defoliated, and top-killed trees.

Increment cores were taken from 12 trees selected randomly from those on the plots. Growth for the most recent 5 years and the previous 5 years was measured in twentieths of an inch.

Data Analysis

Data sheets were sent to ADP for processing.

The increment cores were measured and results were calculated by hand.

RESULTS

There were 83 survey plots established in Yoosa Creek. The infested volumes, as compiled by ADP, are shown in Table 1.

Table 1.--Trees infested by western spruce budworm, Yoosa Creek, Clearwater NF

Species	Total volume/acre	Infested volume/acre	Percent
Grand fir	9,403	9,317	99.1
Engelmann spruce	2,252	2,181	96.8
Douglas-fir	1,255	1,239	98.7
Subalpine fir	772	772	100.0
Western redcedar	405	0	0
Western larch	213	0	0
White pine	211	0	0

Of the 9,403 board feet per acre grand fir figure, 123 board feet or 1.3 percent is top killed.

Increment cores were taken from 12 trees selected at random in the Yoosa Creek area. Growth in twentieths of an inch was measured for the most recent 5 years and for the previous 5 years. The findings are tabulated in Table 2.

Table 2.--Growth in twentieths of an inch of trees infested by western spruce budworm, Yoosa Creek, Clearwater NF

Tree	Species	D.b.h.	Height	Growth recent 5 yrs.	Previous 5 yrs.	Difference
1	Douglas-fir	20	65	15/20	12/20	+ 3/20
2	Grand fir	26	75	9/20	20/20	-11/20
3	Grand fir	10	45	21/20	20/20	+ 1/20
4	Subalpine fir	24	65	7/20	17/20	-10/20
5	Grand fir	20	65	6/20	8/20	- 2/20
6	Grand fir	18	90	9/20	9/20	No change
7	Subalpine fir	22	80	6/20	14/20	- 8/20
8	Subalpine fir	24	80	13/20	10/20	+ 3/20
9	Grand fir	16	75	16/20	26/20	-10/20
10	Douglas-fir	15	81	10/20	12/20	- 2/20
11	Engelmann spruce	27	90	8/20	7/20	+ 1/20
12	Grand fir	9	60	10/20	11/20	- 1/20
	Total			130/20	166/20	-36/20
	Subtotal (-)			64/20	108/20	-44/20
	Subtotal (+)			57/20	49/20	+ 8/20

Since the infestation began, growth has:

1. Declined in seven trees. Average decline = $\frac{6.28}{20}$ or 41 percent.

2. Increased in four trees. Average increase = 2/20 or 16 percent.

3. Not changed in one tree.

The overall effect in the stand:

For 12 trees, the average decline = 3/20 or 22 percent.

How much of the overall 22 percent decline in growth in the stand can be attributed to the western spruce budworm is not known since no control measures are available for comparison.

The total volume per acre on the Yoosa Creek survey area is 14,511 board feet. Grand fir makes up 9,403 board feet or 65 percent of the total. Engelmann spruce, Douglas-fir, and subalpine fir have a combined volume per acre of 4,279 board feet. Thus, over 94 percent of the volume in the area is made up of western spruce budworm host trees. Almost 99 percent of the host volume shows some defoliation (Table 3).

The nonhost species in the area are western redcedar, western larch, and white pine, all with pest problems of their own. Most of the larch volume in the area is made up of scattered older residual trees.

By volume, 1.3 percent of the grand fir is top killed, while by stem count, over 4 percent are top killed. This indicates, as might be expected, that smaller trees are more readily top killed. The detailed data in table 3, however, shows that the average size of the few non-defoliated grand fir is well below the average size of the grand fir as a whole. It may be that small, suppressed grand fir escape attack by virtue of the shielding provided by stand canopy.

Measurements of the increment cores indicate that growth has declined since the infestation began. While not all of the decline may be attributed to the budworm epidemic, it seems very likely that most of it is. As heavy as the infestation is, it is surprising that the growth loss is not greater than it is.

Table 3.--Summary data, western spruce budworm impact survey, Yoosa Creek, Clearwater National Forest

Total acres surveyed: 500 acres
Years of spruce budworm infestation: 3
83 sample plots: BA-20

Species	Volume (bd. ft.) Total	Volume (bd. ft.) /acre	Trees Total	Trees /acre	Average d.b.h.	Average height
GREEN STAND SUMMARY						
Western redcedar	202,602	405	848	1.7	15	49
Grand fir	42,919	86	2,601	5.2	7	32
Western larch	106,533	213	149	.3	27	100
Engelmann spruce	35,743	71	254	.5	12	53
White pine	105,696	211	592	1.2	10	63
Douglas-fir	7,822	16	76	.2	17	45
Total or average	501,315	1,002	4,520	9.1	10	43
TREES SUFFERING MODERATE TO HEAVY SPRUCE BUDWORM DEFOLIATION						
Grand fir	4,597,150	9,194	29,219	58.4	12	52
Subalpine fir	385,889	772	2,532	5.1	15	66
Engelmann spruce	1,090,450	2,181	9,407	18.8	12	49
Douglas-fir	619,538	1,239	6,079	12.2	13	52
Total or average	6,693,027	13,386	47,237	94.5	12	52
TREES SUFFERING TOP KILL						
Grand fir	61,310	123	1,502	3.0	11	41
TOTAL STAND SUMMARY						
	7,255,652	14,511	53,259	106.6	--	--